Dinosaurs' Death Blow in the Caribbean Sea?

According to clues found in a debris layer on Haiti, the dinosaur-killing impact was in or near the Caribbean

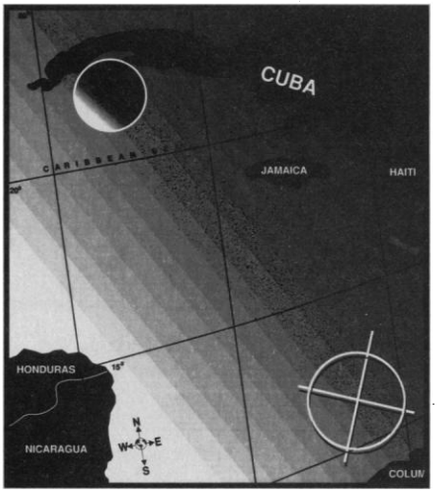
IF AN ASTEROID OR COMET hit Earth 65 million years ago, wiping out the dinosaurs and a host of other species, as most researchers think, where is the crater? Where is the circle of upthrown debris hundreds of kilometers wide that would mark the spot from which so much destruction emanated? A discovery reported on page 843 of this issue of *Science* suggests that the place to look is the Caribbean region. Indeed, two groups already have their bets down on their favorite Caribbean sites for the killer crater.

A credible impact site would complete the evidence for the theory that the mass extinction at the end of the Cretaceous period was triggered by a collision between Earth and an asteroid. The fingerprints of such an event can be seen in the few millimeters of debris that settled to the surface around the globe. That is sufficient evidence for most of the scientists involved in such research. But the small minority that believes a volcanic eruption rather than an asteroid impact was the culprit has long pointed to the absence of convincing evidence for the impact crater.

Up to now, candidate impact sites have been all over the map. They have ranged from the eastern North Pacific to the Indian Ocean and the Soviet edge of the Arctic Ocean, but all along some geologists have favored a spot on or near North America. The leading candidate there has been Manson crater in Iowa, even though it is only 35 kilometers across (*Science*, 9 December 1988, p. 1380). The best dating placed it at or near the time of the catastrophe, and there were other signs that Manson might be the one. After all, it was reasoned, North America holds the largest bits of quartz marked by the shock of the impact, that is, the ones that presumably would fall out closest to the crater. That reasoning was buttressed by the discovery in western North America of two distinct deposits from the impact—material that seemed to have been ejected directly from the crater and an overlying, globally dispersed layer of debris that settled slowly from the atmosphere.

As they report in *Science*, cosmochemists Alan Hildebrand and William Boynton of the University of Arizona have now found a bit of that apparent ejecta layer in Haiti, east of Cuba. But instead of being a couple of centimeters thick, as in Colorado, it is half a meter thick, which should put it far closer to the putative impact site.

There seems little doubt that the Haiti deposit is ejecta from the impact 65 million years ago. Like the deposits in western North America, it lies immediately beneath the thin layer of iridium-rich material dispersed around the globe by the impacting bolide. It contains both shocked quartz and millimeter- to centimeter-size balls that Hildebrand and Boynton interpret as altered versions of the objects called tektites that splash away from large impacts. All these circumstances argue strongly for a large, nearby impact, they say. And that would seem to put Manson out of the running.



One of them a killer? *Two proposed sites for the murderous impact fall in the Caribbean.*

The next steps toward pinpointing the crater will not be easy, and there will no doubt be a variety of candidates. Indeed, already two groups have headed in different directions from Haiti.

Hildebrand and Boynton follow a line of reasoning that leads them far to the south, to a spot in the Caribbean Sea north of Colombia. The Arizona researchers first eliminated continents because geochemical analyses of the impact debris indicated to them that the material came largely, although not entirely, from ocean crust.

They then narrowed the search further by looking at all the marine deposits between North and South America that show or suggest the passage at the end of the Cretaceous of a mega-tsunami, the kilometers-high wave that an ocean impact would trigger. Their conclusion: the giant-wave deposits in the deep waters of the northeast Colombia Basin probably formed closer to the impact than the others. Finally, a search through the records of seismic probings beneath the bottom sediments led them to a 300-kilometer depression that the Arizona group says is their best crater candidate.

Once Hildebrand and Boynton had headed south from Haiti, geologist Bruce Bohor of the U.S. Geological Survey in Denver and materials scientist Russell Seitz of Cambridge, Massachusetts, headed west. After the Arizona group's announcement last fall of their Haiti discovery, Bohor and Seitz sifted through the literature on Caribbean geology and came up with an intriguing conclusion: They believe they have found a 350-meter-thick ejecta bed in Cuba. Known as the Big Boulder Bed, it contains embedded blocks up to 12 meters in diameter. According to its position among the geologic strata, it was laid down at just about the right time to be from the impact.

Although Bohor has not been able to examine the Cuban deposits himself, he says the descriptions in the literature strongly remind him of the ejecta layer hard by the 24-kilometer Ries impact crater of West Germany. The Cuban layer "sounds like exactly the same thing," he says. He and Seitz suggest that the responsible crater might lie just to the south of the western end of Cuba and measure at least 225 kilometers in diameter. Hildebrand is not convinced. Reading the same literature, he sees the Big Boulder Bed as a giant wave deposit, not an ejecta layer.

"I think both [groups] are on the right track," says Caribbean geologist Eric Rosencrantz of the University of Texas at Austin. "But both are shooting from the hip, especially Bohor. His proposal is very much a guess."

Determining who, if anyone, is right should prove challenging. Caribbean geology is poorly understood, being the complex product of 200 million years of jostling between the two bounding continents. The crater may well have been destroyed in the shuffle. And then there are the practical problems of working in places like Cuba, where the cold war has not even begun to thaw. All of which should allow plenty of time to put down more bets on where the killer crater is lurking.

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ADDITIONAL READING

B. Bohor and R. Seitz, "Cuban K/T catastrophe," *Nature* **344**, 539 (1990).